Color, True and Apparent, Low Range

DOC316.53.01252

Platinum-Cobalt Standard Method[1,2,3]

Method 8025

LR (3 to 200 units)

Scope and Application: For water, wastewater and seawater. Equivalent to NCASI method 253 and NCASI Method Color 71.01 for pulp and paper effluent using 465 nm (requires pH adjustment).

[1] Adapted from Standard Methods for the Examination of Water and Wastewater and National Council for Air and Stream Improvement (NCASI) Methods Manual.

[2] Adapted from Wat. Res. Vol. 30, No. 11, pp. 2771–2775, 1996

[3] NCASI Method 253 approved at 40 CFR part 136.

Test preparation

How to use instrument-specific information

The *Instrument-specific information* table shows the sample cell requirements for each instrument. To use this table, select an instrument, then read across to find the sample cell requirements.

Table 1 Instrument-specific information

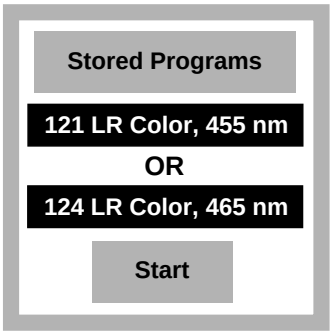
Instrument	Sample cell	Adapter
DR 5000	2629250	A23618
DR 3900, DR 3800, DR 2800, DR 2700	2629250	—

Before starting the test:

NCASI procedure requires pH adjustment. Adjust the pH to 7.6 with 1.0 N HCl or 1.0 N NaOH. When adjusting the pH, if overall volume change is greater than 1%, start over and use a stronger acid or base. Use Program 124 or the 465 nm wavelength program when performing the NCASI procedure. One powder pillow of pH 8 Buffer (sodium phosphate/ potassium phosphate) may be added to 50 ml of sample prior to final pH adjustment to reduce sample dilution effects. Mix thoroughly to dissolve before making final pH adjustments.
A minimum of 6 mL of sample is required for use with the 5-cm cell.
See Method technique on page 3 for precautions in doing low level color measurements.
Insert an adapter if required. Refer to the user manual for orientation.
To test for apparent color, omit steps 3 to 5. Use unfiltered deionized water in Step 6 and unfiltered sample in Step 10.

Collect the following items:	Quantity
Buffer, pH 8.0 (Program 125)	1
Hydrochloric acid solution, 1.0 N (NCASI method at 465 nm only)	varies
Sodium hydroxide, 1.00 N (Program 124 NCASI method at 465 nm only)	varies
Water, deionized	100 mL
FIlter apparatus: membrane filter, filter holder, filter flask and aspirator	1
Sample cell, 5-cm, glass	1
Stopper, rubber, one hole, No. 7	1
Tubing, rubber	1

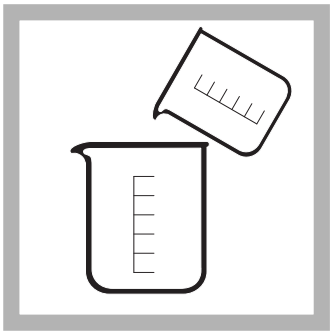
Platinum-Cobalt Standard Method



1. Select the test.

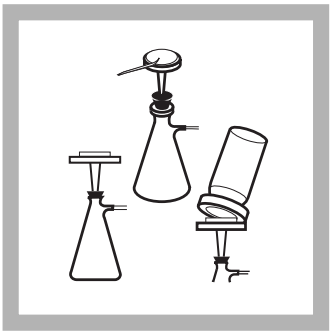
NCASI: Use program 124 for the LR NCASI test.

Refer to Instrument setup on page 4 for programming instructions.



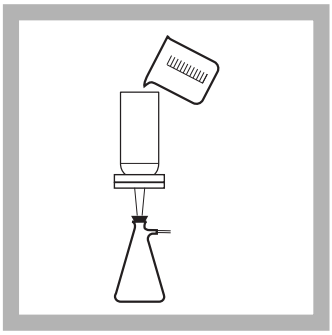
2. Collect 200 mL of sample in a 400-mL beaker.

NCASI: Adjust the pH as described in Test preparation on page 1.

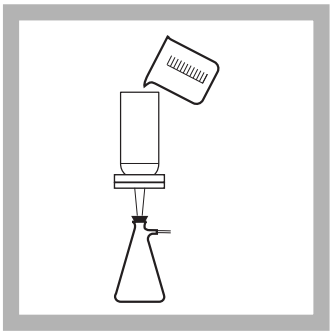


3. Assemble the filtering apparatus (0.45 micron membrane filter, filter holder, filter flask and aspirator).

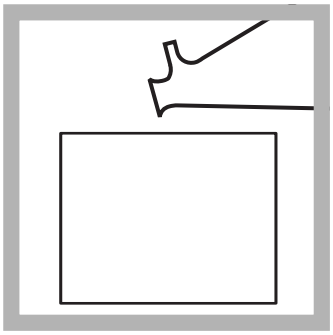
NCASI: Test prescribes a 0.8-micron filter. A 1.0 micron prefilter can be first used for difficult to filter samples.



4. Rinse the filter by pouring approximately 50 mL of deionized water through the filter. Discard the rinse water.

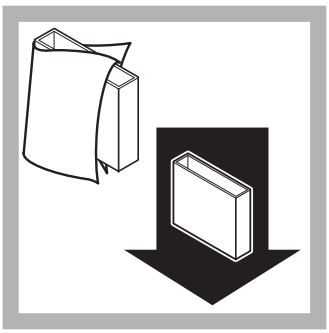


5. Pour another 50 mL of deionized water through the filter.



6. Blank Preparation: Fill a 5-cm (50-mm) pathlength cell with 10 mL of filtered deionized water from step 5.

Discard the excess water in the flask. Drain the flask well to avoid diluting the sample.



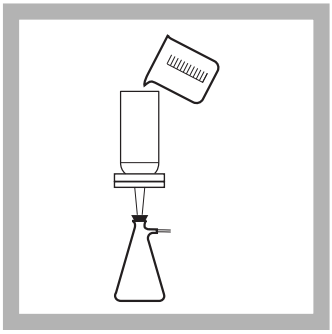
7. Carefully wipe the blank and check the cell for air bubbles or smudges on the cell windows.

Insert the cell into the cell holder.
DR 2700, DR 2800, DR 3800 and DR 3900 instruments: Slide the cell against the right wall of the sample cell compartment to consistently orient the cell. Close the lid.

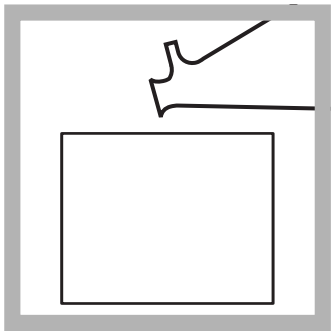
8. Push **ZERO**.

The display will show:

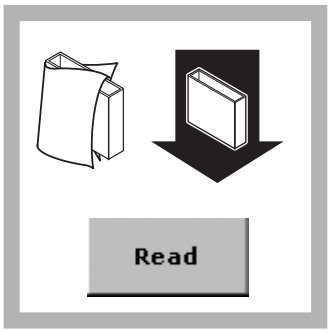
0 units PtCo_50_mm



9. Pour about 50 mL of sample through the filter.



10. Prepared Sample: Remove the blank from the cell holder. Discard the deionized water. Rinse the cell with the filtered sample and then fill with 10 mL of sample.



11. Wipe the prepared sample and check for air bubbles or smudges on the cell windows.

Insert the cell into the cell holder. Close the lid.

Press **READ**. Results are in PtCo color units.

Sample collection, preservation and storage

Collect samples in clean plastic or glass bottles. Most reliable results are obtained when samples are analyzed as soon as possible after collection. If prompt analysis is impossible, fill bottles completely and cap tightly. Avoid excessive agitation or prolonged contact with air. Samples can be stored for 24 hours by cooling to 4 °C (39 °F). Warm to room temperature before analysis.

Accuracy check

Standard solution method

Use a 15 Platinum-Cobalt Color Standard to fill a 5-cm cell. Carefully wipe the cell, check for air bubbles and use in place of sample in Step 10.

Alternately, a 15 mg/L Pt-Co standard can be prepared by pipetting 15.0 mL of a 500 Pt-Co color standard into a 500 mL volumetric flask and diluting to volume with deionized water.

Method performance

Program	Standard	Precision 95% confidence limits of distribution	Sensitivity Concentration change per 0.010 Abs change
455 nm	15 units Pt-Co	14 to 16 units Pt-Co	7.4 units Pt-Co
465 nm	15 units Pt-Co	14 to 16 units Pt-Co	7.6 units Pt-Co

Method technique

Zeroing and reading the sample

It is important to use extremely good lab technique and attention to detail in order to obtain reproducible results on waters that have true color values of less than 15 Pt-Co color units.

1. Wash the 5-cm sample cell with soap and water or acid-rinse the cell to remove any traces of dirt, grease, finger prints, etc. Rinse several times with filtered deionized water.
2. Fill the cleaned cell with at least 6 mL of deionized water. Carefully wipe the cell windows with a lint-free towel.
3. View the cell through the cell windows to check for trapped air bubbles or traces of lint or smudges on or in the cell.
4. Tap the cell lightly on a bench or table to dislodge any trapped air bubbles.

5 Orient the cell in the cell holder and ‘zero’ the instrument. Insert the cell completely into the cell holder of the sample cell compartment (Step 7. on page 2). Close the lid.

Note: *The cell may initially fit tightly in the DR 5000 sample cell holder, but will loosen slightly with additional use. There may be slight variability between cell manufacturers.*

6. Remove the cell and repeat the above procedure for cleaning the cell.

7. Fill the cell again with deionized water and place in the cell holder and read the value. The instrument should read “0” if the sample cell is properly cleaned, no bubbles are present and the cell is consistently oriented in the cell holder.

Filtering the sample

It is questionable if apparent color values are meaningful in low level color measurements. Any turbidity or suspended particles will contribute to the measured color value and will cause high results. It is recommended that all samples for low level color measurements be first filtered through a membrane filter and the results be reported as true color.

After the instrument has been zeroed, discard the deionized water and rinse the cell at least two times with the filtered sample. Fill the sample with filtered sample, check for bubbles or smudges and place the cell into the holder to make the measurement.

Cleaning the sample cells

Thoroughly rinse the sample cell with deionized water and dry after making sample measurements. Place the cell in a dust-free environment and dedicate the cell for LR color measurements only. The sample cleaning procedure will only need to be repeated as necessary for future sample measurements.

Summary of method

Color may be expressed as “apparent” or “true” color. The apparent color includes that from dissolved materials plus that from suspended matter. By filtering or centrifuging out the suspended materials, the true color can be determined. The procedure describes true color analysis. If apparent color is desired, it can be determined by measuring an unfiltered water sample. The stored program is used for both forms of color.

The stored program is calibrated in color units based on the APHA-recommended standard of 1 color unit being equal to 1 mg/L platinum as chloroplatinate ion. Test results for Programs 121 and 124 are measured at 455 and 465 nm, respectively.

Instrument setup

Program setup for the 455 nm method and the 465 nm—NCASI method is applicable for the following instruments:

- DR 2700
- DR 2800
- DR 3800
- DR 3900
- DR 5000 instruments not having PRGMS 121 and 124 available as Stored Programs.

Program setup for the 455 nm method

1. Turn the instrument on and allow the Self-Check to complete.

2. Follow the display prompts and enter commands for the 455 nm method (Table 2).

Table 2 LR color 455 nm program setup

Step	Display shows	Enter	Select
1	Main Menu	User Programs	—
2	User Programs	Program Options	—
3	Program Options	New	—
4	Program Number (950-999)?	Select a Program Number	**OK**
5	Program Name?	LR_Color_455_nm	**NEXT**
6	Program Type	Single Wavelength	**NEXT**
7	Units	Units	**NEXT**
8	Wavelength (nm)	455	**NEXT**
9	Concentration Resolution	1	**NEXT**
10	Chemical Form?	PtCo_50_mm	**NEXT**
11	Calibration	Enter Formula	**NEXT**
12	Enter Formula	b=737.70	**OK>DONE**
13	User Program for number assigned	Upper Limit	**EDIT**
14	Upper Limit	ON>220	**OK>OK**
15	User Program for number assigned	Lower Limit	**EDIT**
16	Lower Limit	ON>3	**OK>OK>STORE**

3. Exit and select the program number assigned for LR Color at 455 nm from the User Programs menu to run the test.

Program setup for 465 nm—NCASI method

1. Turn the instrument on and allow the Self-Check to complete.
2. Follow the display prompts and enter commands for the 465 nm method.

Table 3 LR color 465 nm program setup

Step	Display shows	Enter	Select
1	Main Menu	User Programs	—
2	User Programs	Program Options	—
3	Program Options	New	—
4	Program Number (950-999)?	Select a Program Number	**OK**
5	Program Name?	LR_Color_465_nm	**NEXT**
6	Program Type	Single Wavelength	**NEXT**
7	Units	Units	**NEXT**
8	Wavelength (nm)	465	**NEXT**
9	Concentration Resolution	1	**NEXT**
10	Chemical Form?	PtCo_50_mm	**NEXT**
11	Calibration	Enter Formula	**NEXT**
12	Enter Formula	b=764.00	**OK>DONE**
13	User Program for number assigned	Upper Limit	**EDIT**
14	Upper Limit	ON>220	**OK>OK**
15	User Program for number assigned	Lower Limit	**EDIT**
16	Lower Limit	ON>3	**OK>OK>STORE**

3. Exit and select the program number assigned for LR Color at 465 nm from the User Programs menu.

Consumables and replacement items

Required reagents

Description	Quantity/Test	Unit	Catalog number
Buffer, pH 8.0	1	15/pK	1407995
Hydrochloric acid solution, 1.0 N	varies	1 L	23213-53
Sodium hydroxide, 1.00 N	varies	900 mL	1045-53
Water, deionized	50 mL	4 L	272-56

Required apparatus

Description	Quantity/Test	Unit	Catalog number
Aspirator, nalgene vacuum pump	1	each	2131-00
Filter holder, magnetic, 300 mL graduated, 47-mm	1	each	13529-00
Filter, membrane, 47-mm, 0.8-microns (for NCASI procedure)	1	100/pkg	26408-00
Filter, membrane, 47-mm, 0.45-microns	1	100/pkg	28947-00
Flask, filtering, 500-mL	1	each	546-49
Sample cell, 5 cm (50 mm) pathlength, rectangular glass	1	each	26292-50
Stopper, rubber, one hole, No. 7	1	6/pkg	2119-07
Tubing, rubber, 2.4 mm wall	1	12 ft	560-19

Recommended standards

Description	Unit	Catalog number
Color standard solution, 500 platinum-cobalt units	1 L	1414-53
Color standard solution, 15 platinum-cobalt units	1 L	26028-53

Optional reagents and apparatus

Description	Unit	Catalog number
Detergent, Liqui-Nox	1 L	20881-53
Filter, Glass Microfiber, 47-mm, 1.0 micron	100/pk	2551400
Flask, volumetric, Class A, 500 mL	each	14574-49
Hydrochloric acid; 6.0 N, 1:1	500 mL	884-49
Pipet, volumetric, Class A, 15.00 mL	each	14515-39
Pipet filler, safety bulb	each	14651-00
Sample cell, 5 cm (50 mm) pathlength, rectangular quartz	each	26244-50
Wipers, disposable	280/pk	20970-00

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